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WASTE MANAGEMENT SYSTEMS AND MECHANISMS OF THAILAND AND OVERSEAS

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Abstract

This article purposed to review the systems and mechanisms of waste management in Thailand and overseas for leading to a solution of waste management in a proper way conforming to a current situation of waste in areas. This was a documentary study using an academic document and basic information from the involving departments about waste management. The finding found that the waste management of overseas following the framework of Zero Waste for reducing the amount of waste into least then disposing by proper technology with 3Rs (Reduce Reuse and Recycle) and Polluter Pays Principle : PPP which a mechanism for protecting the waste systematical since production, using, and consuming. These made the overseas solved the waste problem efficiently. The finding suggested that 1) the policy planning should cover the involved activities with the waste management 2) law or tax enforcement 3) promoting to do a research and developing the technology for seriously solving the waste problem in country and 4) promoting the Local

Administration Organizations for cooperation with enterprise in order to manage the waste following the environmental standard in roles, pattern, and directing for efficiency.

Keywords
System and Mechanism, Waste Management, Zero Waste, 3Rs

1. Introduction

The Country Strategic Positioning of National Economic and Social Development issue 12 oriented the country to be a Trading and Service Nation, high income, fair income distribution, center of transportation and logistics in region, center of organic farming and safe agriculture including a center of creative industry by environmental friendly innovation. The good environment in strategic positioning issue 12 was focused on waste management firstly, so the government accelerated the pollution control in air, waste, waste water, dangerous matter from production and consumption as the strategy of waste sorting and recycle then disposing waste in a crisis area, forming a pattern of waste management and dangerous matter by processing into energy and finally stimulating people to realize and discipline for entering the process of correct waste management. (Country Strategic Positioning of National Economic and Social Development Board, 2015)

Waste in our country gain more and more each year as dictated from pollution report of Thailand in 2014, there was 26.19 Gross tons of waste. In 2015 there was more 0.64 Gross tons. The total number of waste was 26.85 Gross tons. Especially for waste found that in 2015, people produce waste 1.13 kg/each/day more than 2014 that had only 1.11 kg/each/day. The amount of waste was a result of city expansion, economic social and technology development. However, the waste in 2015 was 26.85 Gross tons or 73,560 tons per day. The waste from Bangkok was 16% and upcountry 84%. In overall, 19% of waste was used for benefit, 31% was disposed correctly, 27% was disposed incorrectly and 23% was a leftover in area and incorrect dispose. The most amount of waste were in Bangkok, Chon Buri, Nakhon Ratchasima, Samut Prakan and Khon kaen (Pollution Control Department, 2015)

In the past, even Thailand had a law of waste management and dangerous matter such as Act of Environmental promotion and preservation in 1992 or Act of Cleanliness and tidiness in 1992 that assigned the duty of waste management to the Local Administration Organization but the enforcement was not efficient for performance including the lack of

ability and latency of the department so the solution of waste management in overall was not perform systematically and did not succeed apparently. This article aimed at reviewing the system and mechanism of waste management in Thailand and overseas that leading to the appropriate solution for waste management conforming to the current situation in area.

1.1 The Functional Elements of Solid Waste Management

"Waste" for the meaning from the Act of Public Health 1992 means piece of paper, crumb, plastic scrap, matter from street, market, ashes, animal dropping, carcass from menageries. John Pichtel (2014) said about the definition of waste in the book titled Waste Management Practices Municipal, Hazardous, and Industrial that the waste was waste matter, sludge, waste material from factory, commerce, and community not covering another toxin that polluted water and air in the country so the waste was a leftover should be disposed.

Thailand classified the waste into 4 types that were compostable waste 64%, recycle waste 30%, hazardous waste 3%, and generation waste 3%. (Office of waste management, 2014)

The regulation of waste management should keep and move it out of area rapidly for protection the leftovers. The composition of waste transportation are garbage trucks which have a proper size and enough to move the waste in area, staffs who wear the proper suit to protect the pathogen from waste and the hygienic bins that are enough for keeping the waste from people.

The Functional Elements of Solid Waste Management should rely on systematical performance beginning from the origin of waste production then the local administrator disposed them by collecting and classifying such as heating dispose, biogas, and fertilizer. The correct classification of waste leads to the appropriate disposal. (Thares Srisatit, 2010)

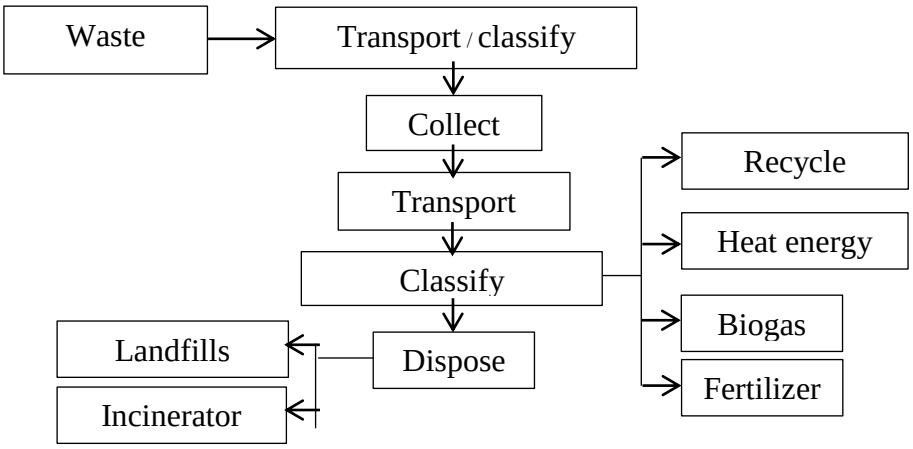

Figure 1: *The Functional Elements of Solid Waste Management*
Source: *Thares Srisatit*, *2010*

2. The Waste Management in Overseas

From the report of What a Waste : A Global Review of Solid Waste Management pointed that the World Bank paid attention to a local waste management if the region could not manage well, it affected people's health, environment and economy of country especially the developing country, the region must take action to manage the waste under the limitation of budget. The waste management in urban area should do rapidly and professional since the urban area is a developing economic zone having overcrowd population as a source of income, a demand of goods and services, food habits, the standard of disposable lifestyle become a cause of an extra quantity of waste in urban area (Hoomweg, D. & Bhada-Tata, P. 2012)

The above report presented the data of population in urban area in 2002 for 2,900 million people which made a waste 0.64 Kg./each/day so the total number of waste was 680 Gross tons per year. Later, in 2012 the population increased to 3,000 million people and made a waste 1.2 Kg./each/day so the total number of waste was 1,300 Gross tons per year. In 2025, there will be population more about 4,300 people and made a waste 1.42 Kg./each/day so the total number of waste will be 2,200 Gross tons per year and in 2050 the more people will make the waste management be more challenging.

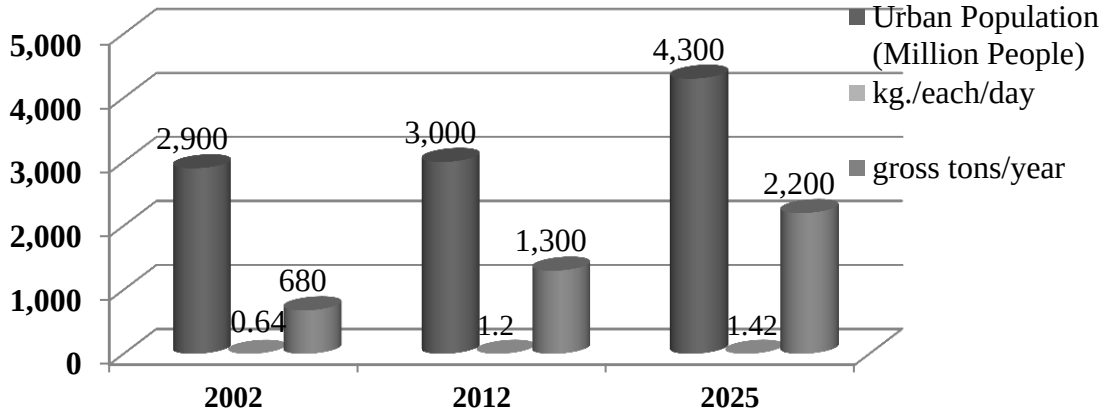

Figure 2: *Increasing Rate of Urban Waste*
Source: *Hoomweg, D. & Bhada-Tata, P. 2012*

A rapid expansion of urban zone in developing countries gained the quantity of waste so the capital of waste management increased from 205,000 US million dollars to 375,000 US million dollars. These situations reflected that the poor countries had to spent much money on waste disposal in urban with various methods such as keeping waste from household, dropping in public bin of community, putting in front of a house for garbage truck to keep, dropping at waste management center including hiring enterprise to keep then people paid for it.

The ability of keeping waste found that the high income countries can keep at most 90% of all while the low income countries can keep only 46% of all. The countries in the Organization for Economic Co-operation and Development – OECD were good at keeping waste about 98% that was different from Africa that kept waste only 46%. The methods of waste disposal were land filling and thermal treatment. The high income countries selected the thermal treatment. The medium or low income countries selected the open dump. (Hoomweg, D. & Bhada-Tata, P. 2012)

However, the finding found that the overseas waste management applied theories and principles into performing mechanism under the policy, regulation, and law of each country conforming his context for example Zero Waste was a reduction of waste for least before disposal with appropriate technology. The protection and reduction of leftover used 3Rs consisted of Reduce Reuse and Recycle for worthwhile using natural resource and realizing the waste production in community. (Thares Srisatit, 2014) In addition, there was a Polluter Pays Principle: PPP that began in 1970 by Organization for Economic Co-operation and

Development: OECD realizing the pollution and taking the environmental costs into the part of production of goods and service. This affected the producer and consumer for adapting their habits to preserve the environment. (Mingsarn Kaosa-ard and Kobkul Rayanakorn, 2009)

The countries using the Zero Waste with 3Rs (Reduce Reuse and Recycle) and Polluter Pays Principle: PPP) as a framework of waste management were Germany, Netherlands, Sweden, England, Canada, Finland, Denmark, America, Australia, Japan, Singapore, India as detail in the below table.

Table1: *Overseas Waste Management*

Country	Principle	Management Mechanism
Germany	Polluter Pays Principle : PPP	Performing under the law of national waste management and law of environment such as pollution control or large combustion plant paid by polluter
Netherlands	Polluter Pays Principle : PPP / 3Rs	Performing by regulation of fee of waste classification and municipality set a center of waste management for providing any kind of waste by having cooperation from federal government, region, people and industrial sector
Sweden	Zero Waste/ 3Rs	Performing the waste classification and developing technology for recycling waste into energy and stimulating people for waste classification
England	Zero Waste/ 3Rs	Performing under the Act of Environment Protection 1990 having an organization of environmental protection issues a permit for setting up a waste factory
Finland	Zero Waste/ 3Rs	Performing on waste processing for energy and fertilizer and levying from landfills
Denmark	Polluter Pays Principle : PPP	Performing under the Act of Environment Protection by bringing tax and refraining tax in case of recycling waste
America	Zero Waste/ 3Rs	Planning to use material for production and adapting the consumer habits into less-polluted products and fixing things for reuse.
Canada	Zero Waste/ 3Rs	Performing under the principle of waste reduction from source, producer's responsibility, reuse, and recycle product
Australia	Zero Waste/ 3Rs	Performing under the cooperation of government, enterprise, and people with enhancing the understanding about waste management and stimulating them to

		participate in performance including the control of landfills area, and waste incineration plant.
Japan	Zero Waste/ 3Rs	Performing under the Act of waste management such as waste management and public cleanliness law, recycling project, container and packaging design, administrated by municipality.
Country	**Principle**	**Management Mechanism**
Singapore	Zero Waste/ 3Rs	Performing by enterprise which was controlled by government sector for campaigning about waste sorting and dropping punctually.
India	Zero Waste/ 3Rs	Performing by government sector for supporting the entrepreneur to build a power station, producing the environment-friendly products and using a recycle material.

From the above table, it had been seen that the process of waste management in each country even had a difference of policy, law, including system and mechanism of performance. However, each country had a similar management on a realization stimulating on environment, considering a good quality of life for people, work procedure having a directly responsible unit, and solving a problem systematically since a producing, using, and consuming. The process of recycle admired the 3Rs (Reduce, Reuse, Recycle) for decreasing the quantity of waste. The control system of waste integrated the performances of every sector in government, enterprise, and people. They focused on the reuse of resource for decreasing the effect on environment in a long run as we seen from EU countries which realized the importance of preserving environment and people life quality. The waste management had adapted from landfills into decreasing the residues in order to reduce the effects of the old landfills. This adaptation can solve the problem of landfill lack. In addition, the EU directive regulated the practices for example, the reduction of waste residue in landfill, the forbidding of burying a hazardous residues and tires, keeping electric and electronics devices, biodegradable treatment, impurities in products and air from innocuous incinerator. (Sirakarn Leungsakul, 2007).

ASEAN Working Group on Environmentally Sustainable Cities (AWGESC) was set in 2004 for the sake of specify the role of monitoring the management of environment, having strategy for waste management under the project of Clean Land that defined the target

of good management of waste that were a collecting, a reduction of waste quantity, a recycle of waste under the principle of Polluter Pays Principle: PPP). The obligation of waste management aimed at performing under the hygienic waste management, reducing the waste production, increasing the green area in urban, making the responsibility and ownership of environment to people including the development of personnel potential to gain the efficiency of work. (The Bangkok Metropolitan Administration, 2011)

2.1 Model of waste management in Asia: Japan, Singapore, Taiwan

The efficient waste management in Asia: case studies of Japan, Singapore, and Taiwan showed the mechanism of performance about waste disposal in a similar way that was the regulation of waste sorting in household before systematic disposal. The waste classification depended on its type, burnable or unburnable. There was a schedule keeping waste from household by garbage truck for instance Taiwan keeps waste from household every day since 5.20 - 5.30 A.M. then the truck bring it into the incinerator for heating disposal.

The waste management in Japan specifies schedule for keeping household waste as Monday is a burnable waste, Tuesday is a plastic and paper waste, Wednesday is a can and bottle, Thursday is a burnable waste and Friday is a unburnable waste. Singapore assigned the enterprise to keep waste from household then transports to the incinerator. The waste disposal by heating found that Taiwan had 3 incinerators, Japan had 20 incinerators, and Singapore had 4 incinerators. The process of incineration defined scale of pollution below the standard for the sake of safety for people around the plants.

In addition, the above countries had got benefit from heating process of waste incineration that was slag. The slag looked like sand and it can be mixed with concrete to make a street, building, and sea filling for example Tokyo Bay, Japan. Japan took the slag to fill in the sea for gaining more area about 1,900 square kilometers. Singapore used the slag for making island at Semakua landfill. The heating disposal earned money by selling the electric energy such as Japan earned 80 million baht per year. Singapore earned from electricity 1440 million baht per year. (https://youtu.be/XcsFhhLhiDA & https://youtu.be/Ey2Woksd97o)

We may say that the mechanism of government focused on an importance of waste. Each country targeted not to gain the quantity of waste since it affected the budget of government to manage. Moreover, the process of waste management should consider the

benefit for infrastructure and public utility. Not only the policy and principle of government shifted the solution of waste problem concretely, but also the mechanism of performance such as a realization of people about waste affecting an environment and health, educating people about orderliness, and responsibility into household and society.

3. The waste management in Thailand

The waste management was an important responsibility of Local Administration Organization existing under the good governance but lack of knowledge and understanding and improving a local law covering the performance systematically such as a reduction of waste at the beginning, a collecting and transportation, a disposal, and a lack of people participation. Therefore, the performance was only a facing problem so the Local Administration Organization should be supported to manage the waste conforming to current situation by increasing the disposal places, building knowledge and follow up continually including enhancing the potential of organization for enforcement the local law. Moreover, there should be informed the realization, consciousness, understanding and participation to people about the correct waste disposal in order that there was an efficient waste disposal at the beginning process. (Vichai Thosuwonchinda, 2015)

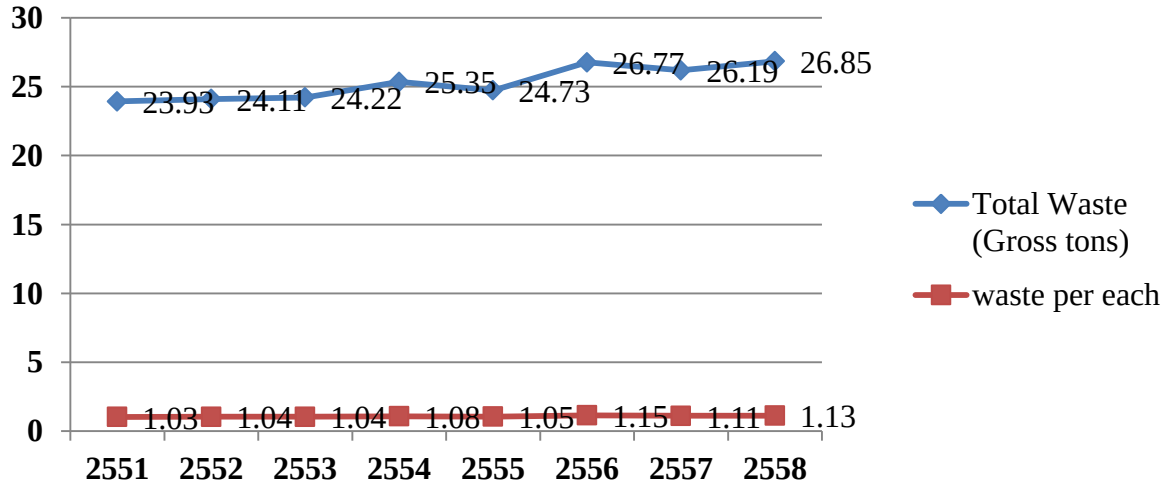

Figure 3: *Waste Production per each and the Total Number in Thailand 2008-2015*
Source: Office of waste disposal and hazardous residues, Pollution Control Department, 2014

From graph showed that Thai people produced waste much more each year affecting the total increasing quantity of waste of country continually. The report of waste management in 2015 found that the waste in country was 26.85 Gross tons or 73,560 tons/day so the rate of

waste production per each increased from 1.11 kg. in 2014 to 1.13 kg. / each/ day. In a process of disposal found that the waste proportion was used for benefit 19% (4.94 Gross tons), correct disposal 31% (8.34 Gross tons), incorrect disposal 27% (7.15 Gross tons), and leftover in area because of incorrect disposal 23% (6.22 Gross tons) (Office of waste disposal and hazardous residues, Pollution Control Department, 2014)

This situation made us see the overview of waste problem cause as the proportion of waste disposal that more than 50% pointed that the waste management was not correct and the leftover was not be disposed on time so the government defined it as a urgent performance, the waste was pronounced as a national agenda in 2014 under the roadmap of waste management and hazardous residues for solving the old piled up waste problem and forming a new pattern of waste management.

3.1 Situation of waste management in Thailand

This article analyzed the situation of waste management in Thailand with SWOT Analysis for knowing the strength, weakness, opportunity, and threat from the performance and the result of analysis led to the suggestion of waste management as following.

The strength of waste management in Thailand was the government saw the importance of solving problem so the government announced the waste management as a national agenda having roadmap to manage the waste and hazardous residues including model scheme for waste management since 2016-2021 for using as a framework and direction of solving problem. In addition there was an objective plan "Thailand Zero Waste" as the way of Pracharat phase 1 (2016-2021) for driving country to the waste free society under the control of Ministry of Natural Resources and Environment and Ministry of Interior as a performing unit following the model scheme of waste management within the budget of 2016-2021 that was 178,600 million baht divided into government budget 94,600 million baht and other budget for example the enterprise sector 84,000 million baht. The government budget consisted of annual government budget 84,400 million baht and Local Administration Organization 9,200 million baht and provincial budget 1,000 million baht.

The weakness was the adaptation of policy to performance, campaign, and people participation. The adaptation from policy to performance was a duty of Local Administration Organization that lacked of the complete administrating system from collecting, sorting, keeping, transporting, and disposing, and recycling. The system of fee levying of a small

Local Administration Organization lacked of efficiency and if they were in a remote area, they disposed the waste by outdoor burning, leaving in the old buddle, or neglected area which was not correct principally that made the effect endangered health and environment including personnel of Local Administration Organization lacked of knowledge and proficiency on planning of waste management in a current situation of area. The campaign was not continued so people do not know the way to manage the waste and lacked of knowledge and understanding and seeing the importance of process of waste management from the first step such as classification, reuse, recycle, keeping, disposal, and taking benefit from residues.

In addition, the opportunity of waste management of Thailand was an ability to perform for pollution protection as an international standard from being a member of Partnership for environment protection and people health about the smuggling the residues dropping in country following the Basel Convention by control of border-transportation of hazardous waste and disposal, affiliating with the partnership of Rotterdam Convention for being pre-notified about hazardous chemicals, herbicide, and some kind of animal as international trade. The Pollution Control Department was a coordination center of obligation of Stockholm convention about persistent organic pollutants (POPs) for protection the pollution on people in a long run.

However, the threat was found from domestic performance factors such as the government sector had no measure for import duty reduction on machine of waste management including no budget for building waste disposal system for getting renewable energy. Gathering area for waste management was limited. The enterprise sector was risk from policy or performance changing from the politicians who administrated the Local Administration Organization, the efficiency of performance of enterprise decreased because of purchase and budget problem so the enterprise sector could not run as the condition specified and affected the efficiency of waste management.

4. Summary

The waste management was a fundamental infrastructure from government that should have an appropriate management for protection the effect occurred directly on people health and environment of country. The direction of waste management overseas focused on an environment preservation and good quality of life of people, taking the "Zero Waste" for

reducing the quantity of waste for least before disposal with technology and 3Rs (Reduce Reuse และ Recycle) for using resource worthwhile, and taking the Polluter Pays Principle (PPP) as a mechanism of protection the waste problem occurred from production process, using, and consume. The performance of waste management was integrated by central government sector and local sector for making a participatory cooperation between enterprises for investment in waste management completely in the same time of making realization and cooperation of people into the process of waste management from the beginning point through the fostering of orderliness and responsibility on youths for learning and seeing a form of waste reduction, recycle, and efficient waste sorting.

Thailand even had involved laws for enforcement such as the Act of Environment Preservation 1992 or the Act of Cleanliness and Orderliness 1992 that the enforcement lacked of efficiency since the adaptation from policy to performance of Local Administration Organization. The limitation of performance was the ability and potential of waste management in area so the solving problem of waste in overall could not be run systematically and no success concretely therefore the suggestion was as following

1. Policy and law should cover the involved activities of waste management for instance importing raw material for producing goods, consuming, waste sorting, keeping the waste, organization for waste management including the plants for disposal or treatment the waste in every area.

2. Law enforcement or tax measure for control the administration of waste in country for going in the same way.

3. Supporting to do a research and developing modern technology for solving the waste problem successfully.

4. Supporting the Local Administration Organization prepared for cooperation with enterprise in the waste management following the environmental standard in role, performance, and following up in order to have efficiency in administration.

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